BAB 9
PENUTUP

Pada Bab ini mencakup kesimpulan yang diambil dari hasil penelitian yang telah dilakukan dan saran untuk penelitian selanjutnya.

9.1. Kesimpulan

Berdasarkan pemodelan matematis, analisis, dan pembahasan dari penelitian yang telah dilakukan maka dapat ditarik kesimpulan sebagai berikut:

a. Model total biaya gabungan yang merupakan pengembangan model Banerjee (1986) dan Prasetyo dan Fauza (2006) dinyatakan dengan persamaan berikut:

$$TRC_g = D.C_1 + \frac{D}{Q}.S_1 + \frac{Q}{2}.h_1.C_1 + D.C_2 + \frac{D}{Q}.S_2 + \frac{D}{P}.\frac{Q}{2}.h_2.C_2 + \frac{\eta.D(1-q^Q)}{Q} + C_r.\theta.\frac{D}{Q}.\left(Q - q\frac{(1-q^Q)}{(1-q)}\right)$$

b. Kebijakan ukuran lot yang digunakan dalam penelitian untuk menentukan harga jual produk per unit dari sudut pandang pemasok meliputi EOQ, EPQ, dan ukuran lot gabungan.

c. Berdasarkan contoh numerik, ukuran lot terendah diperoleh dengan menggunakan kebijakan EOQ yaitu 325,688 unit tetapi harga jual produknya paling tinggi yaitu \$7,54/unit. Dengan kebijakan EPQ, ukuran lot yang diperoleh adalah 6.673,339 unit dengan harga jual produk \$6,15/unit. Sedangkan dengan menggunakan kebijakan ukuran lot gabungan diperoleh harga jual produk \$6,24/unit dan ukuran lot 2.393,417 unit.

d. Pengembangan model Banerjee (1986) dengan penambahan biaya perbaikan dan restorasi dari model Prasetyo dan Fauza (2006) menghasilkan total biaya gabungan terendah jika menggunakan kebijakan ukuran lot gabungan.

e. Meskipun pada masing-masing model penelitian kebijakan ukuran lot yang digunakan berbeda dan menghasilkan nilai harga jual produk dan ukuran lot yang berbeda pula, pemasok tetap mencapai target keuntungan yang telah ditetapkan yaitu \$1,5/unit.

f. Berdasarkan hasil uji analisis sensitivitas, solusi optimal sensitif terhadap perubahan parameter jumlah permintaan produk per periode (*D*) dan relatif

tidak sensitif terhadap nilai parameter setup pemasok (S_2) dan biaya inventori pemasok (h_2).

9.2. Saran

Model pada penelitian kali ini masih digunakan banyak asumsi dan belum melibatkan biaya-biaya yang relevan. Maka pengembangan model dengan biaya-biaya yang relevan yang sesuai dengan kenyataan dan disertai implementasi dapat digunakan untuk penelitian selanjutnya.

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LAMPIRAN

Lampiran 1. Perhitungan ukuran lot dan harga jual dengan kebijakan EOQ

Diketahui

$D := 12000$	$S1 := 10$	$\theta := 0.0001$
$P := 48000$	$S2 := 500$	$q := 0.95$
$h1 := 0.30$	$C2 := 4.5$	$\eta := 1$
$h2 := 0.24$	$G := 1.5$	$Cr := 0.5$

$$TRC1 := D \cdot C1 + \frac{D}{Q} \cdot S1 + \frac{Q \cdot h1 \cdot C1}{2}$$

$$TRC2 := D \cdot C2 + \frac{D}{Q} \cdot S2 + \frac{D \cdot Q \cdot h2 \cdot C2}{2 \cdot P} + \frac{\eta \cdot D \cdot \left(1 - q^{Q}\right)}{Q} + Cr \cdot \theta \cdot D \cdot \left[1 - q \cdot \frac{1 - q^{Q}}{Q \cdot (1 - q)}\right]$$

$$Q := \sqrt{\frac{2 \cdot D \cdot S1}{C1 \cdot h1}}$$

Metode Newton-Raphson

Iterasi 0

$C1 := C2 + G = 6$

$$fC1 := C1 - C2 - \frac{S2}{\sqrt{\frac{2 \cdot D \cdot S1}{C1 \cdot h1}}} - \frac{\sqrt{\frac{2 \cdot D \cdot S1}{C1 \cdot h1}} \cdot h2 \cdot C2}{2 \cdot P} - \frac{\eta \cdot \left(1 - q^{\sqrt{\frac{2 \cdot D \cdot S1}{C1 \cdot h1}}}\right)}{\sqrt{\frac{2 \cdot D \cdot S1}{C1 \cdot h1}}} - Cr \cdot \theta \cdot \left[1 - q \cdot \frac{1 - q^{\sqrt{\frac{2 \cdot D \cdot S1}{C1 \cdot h1}}}}{\sqrt{\frac{2 \cdot D \cdot S1}{C1 \cdot h1}} \cdot (1 - q)}\right] - G = -1.3762$$

$$ffC1 := \frac{\sqrt{2}\cdot D\cdot S1\cdot\eta\cdot\left(q^{\sqrt{2}\cdot\sqrt{\frac{D\cdot S1}{C1\cdot h1}}}-1\right)}{4\cdot C1^2\cdot h1\cdot\left(\frac{D\cdot S1}{C1\cdot h1}\right)^{\frac{3}{2}}} - \frac{\eta\cdot q^{\sqrt{2}\cdot\sqrt{\frac{D\cdot S1}{C1\cdot h1}}}\cdot\ln(q)}{2\cdot C1} - \frac{\sqrt{2}\cdot D\cdot S1\cdot S2}{4\cdot C1^2\cdot h1\cdot\left(\frac{D\cdot S1}{C1\cdot h1}\right)^{\frac{3}{2}}} - Cr\cdot\theta\cdot\left[\frac{q\cdot q^{\sqrt{2}\cdot\sqrt{\frac{D\cdot S1}{C1\cdot h1}}}\cdot\ln(q)}{2\cdot C1\cdot(q-1)} - \frac{\sqrt{2}\cdot D\cdot S1\cdot q\cdot\left(q^{\sqrt{2}\cdot\sqrt{\frac{D\cdot S1}{C1\cdot h1}}}-1\right)}{4\cdot C1^2\cdot h1\cdot(q-1)\cdot\left(\frac{D\cdot S1}{C1\cdot h1}\right)^{\frac{3}{2}}}\right] + \frac{\sqrt{2}\cdot C2\cdot D\cdot S1\cdot h2}{4\cdot C1^2\cdot P\cdot h1\cdot\sqrt{\frac{D\cdot S1}{C1\cdot h1}}} + 1 = 0.886005$$

$$Gross0 := C1 - C2 - \frac{S2}{\sqrt{\frac{2\cdot D\cdot S1}{C1\cdot h1}}} - \frac{\sqrt{\frac{2\cdot D\cdot S1}{C1\cdot h1}}\cdot h2\cdot C2}{2\cdot P} - \frac{\eta\cdot\left(1-q^{\sqrt{\frac{2\cdot D\cdot S1}{C1\cdot h1}}}\right)}{\sqrt{\frac{2\cdot D\cdot S1}{C1\cdot h1}}} - Cr\cdot\theta\cdot\left[1-q\cdot\frac{1-q^{\sqrt{\frac{2\cdot D\cdot S1}{C1\cdot h1}}}}{\sqrt{\frac{2\cdot D\cdot S1}{C1\cdot h1}}\cdot(1-q)}\right] = 0.1238$$

Iterasi 1

$$C11 := C1 - \frac{fC1}{ffC1} = 7.5533$$

$$fC11 := C11 - C2 - \frac{S2}{\sqrt{\frac{2\cdot D\cdot S1}{C11\cdot h1}}} - \frac{\sqrt{\frac{2\cdot D\cdot S1}{C11\cdot h1}}\cdot h2\cdot C2}{2\cdot P} - \frac{\eta\cdot\left(1-q^{\sqrt{\frac{2\cdot D\cdot S1}{C11\cdot h1}}}\right)}{\sqrt{\frac{2\cdot D\cdot S1}{C11\cdot h1}}} - Cr\cdot\theta\cdot\left[1-q\cdot\frac{1-q^{\sqrt{\frac{2\cdot D\cdot S1}{C11\cdot h1}}}}{\sqrt{\frac{2\cdot D\cdot S1}{C11\cdot h1}}\cdot(1-q)}\right] - G = 0.010125$$

$$ffC11 := \frac{\sqrt{2}\cdot D\cdot S1\cdot\eta\cdot\left(q^{\sqrt{2}\cdot\sqrt{\frac{D\cdot S1}{C11\cdot h1}}}-1\right)}{4\cdot C11^2\cdot h1\cdot\left(\frac{D\cdot S1}{C11\cdot h1}\right)^{\frac{3}{2}}} - \frac{\eta\cdot q^{\sqrt{2}\cdot\sqrt{\frac{D\cdot S1}{C11\cdot h1}}}\cdot\ln(q)}{2\cdot C11} - \frac{\sqrt{2}\cdot D\cdot S1\cdot S2}{4\cdot C11^2\cdot h1\cdot\left(\frac{D\cdot S1}{C11\cdot h1}\right)^{\frac{3}{2}}} - Cr\cdot\theta\cdot\left[\frac{q\cdot q^{\sqrt{2}\cdot\sqrt{\frac{D\cdot S1}{C11\cdot h1}}}\cdot\ln(q)}{2\cdot C11\cdot(q-1)} - \frac{\sqrt{2}\cdot D\cdot S1\cdot q\cdot\left(q^{\sqrt{2}\cdot\sqrt{\frac{D\cdot S1}{C11\cdot h1}}}-1\right)}{4\cdot C11^2\cdot h1\cdot(q-1)\cdot\left(\frac{D\cdot S1}{C11\cdot h1}\right)^{\frac{3}{2}}}\right] + \frac{\sqrt{2}\cdot C2\cdot D\cdot S1\cdot h2}{4\cdot C11^2\cdot P\cdot h1\cdot\sqrt{\frac{D\cdot S1}{C11\cdot h1}}} + 1 = 0.898338$$

$$Gross1 := C11 - C2 - \frac{S2}{\sqrt{\frac{2 \cdot D \cdot S1}{C11 \cdot h1}}} - \frac{\sqrt{\frac{2 \cdot D \cdot S1}{C11 \cdot h1}} \cdot h2 \cdot C2}{2 \cdot P} - \frac{\eta \cdot \left(1 - q \sqrt{\frac{2 \cdot D \cdot S1}{C11 \cdot h1}}\right)}{\sqrt{\frac{2 \cdot D \cdot S1}{C11 \cdot h1}}} - Cr \cdot \theta \cdot \left[1 - q \cdot \frac{1 - q \sqrt{\frac{2 \cdot D \cdot S1}{C11 \cdot h1}}}{\sqrt{\frac{2 \cdot D \cdot S1}{C11 \cdot h1}} \cdot (1 - q)}\right] = 1.5101$$

Iterasi 2

$$C111 := C11 - \frac{fC11}{ffC11} = 7.542$$

$$fC111 := C111 - C2 - \frac{S2}{\sqrt{\frac{2 \cdot D \cdot S1}{C111 \cdot h1}}} - \frac{\sqrt{\frac{2 \cdot D \cdot S1}{C111 \cdot h1}} \cdot h2 \cdot C2}{2 \cdot P} - \frac{\eta \cdot \left(1 - q \sqrt{\frac{2 \cdot D \cdot S1}{C111 \cdot h1}}\right)}{\sqrt{\frac{2 \cdot D \cdot S1}{C111 \cdot h1}}} - Cr \cdot \theta \cdot \left[1 - q \cdot \frac{1 - q \sqrt{\frac{2 \cdot D \cdot S1}{C111 \cdot h1}}}{\sqrt{\frac{2 \cdot D \cdot S1}{C111 \cdot h1}} \cdot (1 - q)}\right] - G = 4.257349 \times 10^{-7}$$

$$ffC111 := \frac{\sqrt{2} \cdot D \cdot S1 \cdot \eta \cdot \left(q \sqrt{\frac{D \cdot S1}{C111 \cdot h1}} - 1\right)}{4 \cdot C111^2 \cdot h1 \cdot \left(\frac{D \cdot S1}{C111 \cdot h1}\right)^{\frac{3}{2}}} - \frac{\eta \cdot q \sqrt{\frac{D \cdot S1}{C111 \cdot h1}} \cdot \ln(q)}{2 \cdot C111} - \frac{\sqrt{2} \cdot D \cdot S1 \cdot S2}{4 \cdot C111^2 \cdot h1 \cdot \left(\frac{D \cdot S1}{C111 \cdot h1}\right)^{\frac{3}{2}}} - Cr \cdot \theta \cdot \left[\frac{q \cdot q \sqrt{\frac{D \cdot S1}{C111 \cdot h1}} \cdot \ln(q)}{2 \cdot C111 \cdot (q - 1)} - \frac{\sqrt{2} \cdot D \cdot S1 \cdot q \cdot \left(q \sqrt{\frac{D \cdot S1}{C111 \cdot h1}} - 1\right)}{4 \cdot C111^2 \cdot h1 \cdot (q - 1) \cdot \left(\frac{D \cdot S1}{C111 \cdot h1}\right)^{\frac{3}{2}}}\right] + \frac{\sqrt{2} \cdot C2 \cdot D \cdot S1 \cdot h2}{4 \cdot C111^2 \cdot P \cdot h1 \cdot \sqrt{\frac{D \cdot S1}{C111 \cdot h1}}} + 1 = 0.898262$$

$$Gross2 := C111 - C2 - \frac{S2}{\sqrt{\frac{2 \cdot D \cdot S1}{C111 \cdot h1}}} - \frac{\sqrt{\frac{2 \cdot D \cdot S1}{C111 \cdot h1}} \cdot h2 \cdot C2}{2 \cdot P} - \frac{\eta \cdot \left(1 - q \sqrt{\frac{2 \cdot D \cdot S1}{C111 \cdot h1}}\right)}{\sqrt{\frac{2 \cdot D \cdot S1}{C111 \cdot h1}}} - Cr \cdot \theta \cdot \left[1 - q \cdot \frac{1 - q \sqrt{\frac{2 \cdot D \cdot S1}{C111 \cdot h1}}}{\sqrt{\frac{2 \cdot D \cdot S1}{C111 \cdot h1}} \cdot (1 - q)}\right] = 1.5$$

Iterasi 3

$$C1V := C111 - \frac{fC111}{ffC111} = 7.542$$

$$fC1V := C1V - C2 - \frac{S2}{\sqrt{\frac{2 \cdot D \cdot S1}{C1V \cdot h1}}} - \frac{\sqrt{\frac{2 \cdot D \cdot S1}{C1V \cdot h1}} \cdot h2 \cdot C2}{2 \cdot P} - \frac{\eta \cdot \left(1 - q \sqrt{\frac{2 \cdot D \cdot S1}{C1V \cdot h1}}\right)}{\sqrt{\frac{2 \cdot D \cdot S1}{C1V \cdot h1}}} - Cr \cdot \theta \cdot \left[1 - q \cdot \frac{1 - q \sqrt{\frac{2 \cdot D \cdot S1}{C1V \cdot h1}}}{\sqrt{\frac{2 \cdot D \cdot S1}{C1V \cdot h1}} \cdot (1 - q)}\right] - G = 1.110223 \times 10^{-15}$$

$$ffC1V := \frac{\sqrt{2} \cdot D \cdot S1 \cdot \eta \cdot \left(q^{\sqrt{2} \cdot \sqrt{\frac{D \cdot S1}{C1V \cdot h1}}} - 1\right)}{4 \cdot C1V^2 \cdot h1 \cdot \left(\frac{D \cdot S1}{C1V h1}\right)^{\frac{3}{2}}} - \frac{\eta \cdot q^{\sqrt{2} \cdot \sqrt{\frac{D \cdot S1}{C1V \cdot h1}}} \cdot \ln(q)}{2 \cdot C1V} - \frac{\sqrt{2} \cdot D \cdot S1 \cdot S2}{4 \cdot C1V^2 \cdot h1 \cdot \left(\frac{D \cdot S1}{C1V h1}\right)^{\frac{3}{2}}} - Cr \cdot \theta \cdot \left[\frac{q \cdot q^{\sqrt{2} \cdot \sqrt{\frac{D \cdot S1}{C1V \cdot h1}}} \cdot \ln(q)}{2 \cdot C1V \cdot (q - 1)} - \frac{\sqrt{2} \cdot D \cdot S1 \cdot q \cdot \left(q^{\sqrt{2} \cdot \sqrt{\frac{D \cdot S1}{C1V \cdot h1}}} - 1\right)}{4 \cdot C1V^2 \cdot h1 \cdot (q - 1) \cdot \left(\frac{D \cdot S1}{C1V h1}\right)^{\frac{3}{2}}}\right] + \frac{\sqrt{2} \cdot C2 \cdot D \cdot S1 \cdot h2}{4 \cdot C1V^2 \cdot P \cdot h1 \cdot \sqrt{\frac{D \cdot S1}{C1V h1}}} + 1 = 0.898262$$

$$Gross3 := C1V - C2 - \frac{S2}{\sqrt{\frac{2 \cdot D \cdot S1}{C1V \cdot h1}}} - \frac{\sqrt{\frac{2 \cdot D \cdot S1}{C1V \cdot h1}} \cdot h2 \cdot C2}{2 \cdot P} - \frac{\eta \cdot \left(1 - q \sqrt{\frac{2 \cdot D \cdot S1}{C1V \cdot h1}}\right)}{\sqrt{\frac{2 \cdot D \cdot S1}{C1V \cdot h1}}} - Cr \cdot \theta \cdot \left[1 - q \cdot \frac{1 - q \sqrt{\frac{2 \cdot D \cdot S1}{C1V \cdot h1}}}{\sqrt{\frac{2 \cdot D \cdot S1}{C1V \cdot h1}} \cdot (1 - q)}\right] = 1.5$$

Lampiran 2. Perhitungan total biaya pembeli, pemasok, dan gabungan dengan kebijakan EOQ

Diketahui

$D := 12000$	$S1 := 10$	$\theta := 0.0001$
$P := 48000$	$S2 := 500$	$q := 0.95$
$h1 := 0.30$	$C2 := 4.5$	$\eta := 1$
$h2 := 0.24$	$G := 1.5$	$Cr := 0.5$

$C1 := 7.542$

$$Q := \sqrt{\frac{2 \cdot D \cdot S1}{C1 \cdot h1}} = 325.688$$

Total Biaya Pembeli, Pemasok, dan Gabungan

$$TRC1 := D \cdot C1 + \frac{D}{Q} \cdot S1 + \frac{Q \cdot h1 \cdot C1}{2} = 9.1240901622 \times 10^4$$

$$TRC2 := D \cdot C2 + \frac{D}{Q} \cdot S2 + \frac{D \cdot Q \cdot h2 \cdot C2}{2 \cdot P} + \frac{\eta \cdot D \cdot \left(1 - q^{Q}\right)}{Q} + Cr \cdot \theta \cdot D \cdot \left[1 - q \cdot \frac{1 - q^{Q}}{Q \cdot (1 - q)}\right] = 7.2503918495 \times 10^4$$

$$TRCg := D \cdot C1 + \frac{D}{Q} \cdot S1 + \frac{Q \cdot h1 \cdot C1}{2} + D \cdot C2 + \frac{D}{Q} \cdot S2 + \frac{D \cdot Q \cdot h2 \cdot C2}{2 \cdot P} + \frac{\eta \cdot D \cdot \left(1 - q^{Q}\right)}{Q} + Cr \cdot \theta \cdot D \cdot \left[1 - q \cdot \frac{1 - q^{Q}}{Q \cdot (1 - q)}\right] = 1.6374482012 \times 10^5$$

Lampiran 3. Perhitungan total biaya pembeli, pemasok, dan gabungan dengan kebijakan EPQ

Diketahui

$D := 12000$	$S1 := 10$	$\theta := 0.0001$
$P := 48000$	$S2 := 500$	$q := 0.95$
$h1 := 0.30$	$C2 := 4.5$	$\eta := 1$
$h2 := 0.24$	$G := 1.5$	$Cr := 0.5$

$C1 := 6.15019990016755$

$Q := 6673.33947843051$

Total Biaya Pembeli, Pemasok, dan Gabungan

$$TRC1 := D \cdot C1 + \frac{D}{Q} \cdot S1 + \frac{Q \cdot h1 \cdot C1}{2} = 7.9976736573 \times 10^4$$

$$TRC2 := D \cdot C2 + \frac{D}{Q} \cdot S2 + \frac{D \cdot Q \cdot h2 \cdot C2}{2 \cdot P} + \frac{\eta \cdot D \cdot \left(1 - q^Q\right)}{Q} + Cr \cdot \theta \cdot D \cdot \left[1 - q \cdot \frac{1 - q^Q}{Q \cdot (1 - q)}\right] = 5.5802397393 \times 10^4$$

$$TRCg := D \cdot C1 + \frac{D}{Q} \cdot S1 + \frac{Q \cdot h1 \cdot C1}{2} + D \cdot C2 + \frac{D}{Q} \cdot S2 + \frac{D \cdot Q \cdot h2 \cdot C2}{2 \cdot P} + \frac{\eta \cdot D \cdot \left(1 - q^Q\right)}{Q} + Cr \cdot \theta \cdot D \cdot \left[1 - q \cdot \frac{1 - q^Q}{Q \cdot (1 - q)}\right] = 1.3577913397 \times 10^5$$

Lampiran 4. Perhitungan total biaya pembeli, pemasok, dan gabungan dengan kebijakan Ukuran Lot Gabungan

Diketahui

$D := 12000$	$S1 := 10$	$\theta := 0.0001$
$P := 48000$	$S2 := 500$	$q := 0.95$
$h1 := 0.30$	$C2 := 4.5$	$\eta := 1$
$h2 := 0.24$	$G := 1.5$	$Cr := 0.5$

$C1 := 6.23629965859029$

$Q := 2393.4170665328$

Total Biaya Pembeli, Pemasok, dan Gabungan

$$TRC1 := D \cdot C1 + \frac{D}{Q} \cdot S1 + \frac{Q \cdot h1 \cdot C1}{2} = 7.712464333 \times 10^4$$

$$TRC2 := D \cdot C2 + \frac{D}{Q} \cdot S2 + \frac{D \cdot Q \cdot h2 \cdot C2}{2 \cdot P} + \frac{\eta \cdot D \cdot \left(1 - q^{Q}\right)}{Q} + Cr \cdot \theta \cdot D \cdot \left[1 - q \cdot \frac{1 - q^{Q}}{Q \cdot (1 - q)}\right] = 5.6835596376 \times 10^4$$

$$TRCg := D \cdot C1 + \frac{D}{Q} \cdot S1 + \frac{Q \cdot h1 \cdot C1}{2} + D \cdot C2 + \frac{D}{Q} \cdot S2 + \frac{D \cdot Q \cdot h2 \cdot C2}{2 \cdot P} + \frac{\eta \cdot D \cdot \left(1 - q^{Q}\right)}{Q} + Cr \cdot \theta \cdot D \cdot \left[1 - q \cdot \frac{1 - q^{Q}}{Q \cdot (1 - q)}\right] = 1.3396023971 \times 10^5$$